St Mary's University Twickenham London
Institute of Education

St Mary's secondary science PGCE biology practical booklet

2025-2026

Name _____

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General information

Over these practical days you will be completing a series of biology required practicals.

The intended outcomes of these sessions are:

- To ensure you are familiar with example required practicals
- To identify sources for practical procedure
- To reflect on how you may teach/introduce required practicals within a wider unit.
- To evaluate resources available.

In each session there will be an opportunity to record results and answer set questions. I would strongly advise you complete each of the tasks set to get a feel of the expectations upon students and any key skills you may need to reinforce.

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Session 1 Aim examine how working scientifically are blended with substantive knowledge in formative and summative assessments.

The study of enzymes is a biochemistry topic that BEST places under the Big theme of the cellular basis of life. It is helpful to ensure the students have the following foundational knowledge before moving onto enzymes.

Presupposed knowledge from KS3	Knowledge covered in KS4
Cell structure plant cells vs animal cells How cells are specialised Cells, tissue organs and organ systems Procaryotic and eucaryotic cells	Procaryotic and eucaryotic cells, providing a more detailed understanding of the organelles within animal cells, plant cellsbacteria and viruss. How each type of cell reproduces. Factors affecting rate of reaction (chemistry)

Why might students struggle to relate enzyme activity to the topic of rates of reaction in chemistry?

What action could you take as a teacher to support students develop their schema across scientific disciplines?

An example best RETRIEVAL ACTIVITY

Prokaryotic cell structures

The following words are all cell structures:

1. Cell membrane	**2.** Cell wall	**3.** Chloroplasts	**4.** Cytoplasm
5. DNA	**6.** Flagella	**7.** Mitochondria	
8. Nucleus	**9.** Plasmids	**10.** Ribosomes	**11.** Vacuole

Which statement, **A**, **B**, **C** or **D**, is correct for **each** structure?

A All prokaryotic cells have this structure.

B Some prokaryotic cells have this structure.

C No prokaryotic cells have this structure.

D I'm not sure.

In one of the microtecah activities where the topic was cell structure one of the teachers added the following

Slide. Why is this particularly helpful in overcoming misconceptions about cell structure?

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Investigating the effect of pH on amylase activity preparation task

Pre lab 1

One of the skills required for students to successfully complete the experiments is to write a risk assessment of the practical. This should include the risk (i.e. how dangerous it would be if something happened) how likely that is is to occur and what you would do if an accident happened.

Below is an example of a risk assessment completed for a chemistry required practical. To calculate the risk, you need to multiply the likelihood by the severity. If your experiment is medium or high risk you must include extra precautions you will take to minimise risk.

Use this to complete a risk assessment of the practical investigating the effect of pH on amylase activity.

Input likelihood and severity (take into account personnel involved). Multiply these two numbers together (formula already completed for you) to arrive at the overall risk factor.

1 = Least Risk. 36 = Highest Risk. 0 - 11 = Low Risk 12 - 24 = Medium Risk 25 - 36 = High Risk

Likelihood	Severity		Department:				Date of Completion:	If the Highest Rated Risk factor is greater than 24 please discuss with School Manager	
6 = Certain/imminent	6 = Fatality		Science				26/05/2017		
5 = Very likely	5 = Severe injury								
4 = Likely	4 = Lost time		Risk assessment conducted by				Highest Rated risk:		
3 = Possible	3 = No Lost time								
2 = Unlikely	2 = Minor injury		Robert Campebll				6		
1 = Very unlikely	1 = No injury								
Hazards Present: (Choose from Physical (P), Chemical(C), Biological (B), Ergonomic (E), Psychological (PY) (e.g. Check storage/slippery area, dangerous liquids, waste, storage, electric equipment, lights, faulty equipment)		**Who might be harmed and how?**	**Is the risk adequately controlled? List existing controls. (e.g. Signs, instructions, department policy, staff/student training)**	**L**	**S**	**R**	**What further controls/action is required? (e.g. Discussion/information sharing, signs, create lists/checks)**	**Action By whom and by when**	**Date Completed**
Glassware breaking and cutting someone (P)		Teacher, technician, site staff or student. If glassware were to smash either teachers or students could get cut if handling	Brush and pan in each preproom. Separate glass bin in prep room 1. Glass disposed of by Theo by liasing with site staff.	3	2	6	Extra glass bin to be ordered in for prep room 2. The risk can be minimised by placing glassware away from the edges	teachers to ensure safety met before the practical is started. Technicians and site staff for disposal of broken glass	ongoing
Sulfamic acid (C) Toxic if injested If a concentration of greater than 0.3 mol dm-3 should be labelled as an irritant concentrations of greater than 0.8 moldm-3 should be labelled as corrosive		student, teacher or technician	Risk is minimised as the acid is given to students as a solid. Students are instructed to measure 2.5g of the acid. Mass less than 2.9g will give a concnentration less than 0.3moldm-3 and minimise risk. Students should weigh out sulfamic acid in weighing boats and be instructed to wash hands before eating food. Students wear safety specs to avoid risking solid material entering the eye.	1	4	4	Ensure teachers are aware and inform students to measure out less than 2.9g of sulfamic acid in the experiment.	teachers	ongoing

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l = Least Risk. 36 = Highest Risk. 0 - 11 = Low Risk 12 - 24 = Medium Risk 25 - 36 = High Risk

Likelihood	Severity
= Certain/imminent	6 = Fatality
= Very likely	5 = Severe injury
= Likely	4 = Lost time
= Possible	3 = No Lost time
= Unlikely	2 = Minor injury
= Very unlikely	1 = No injury

Department:	Date of Completion:	If the Highest Rated Risk factor is greater than 24 please discuss with School Manager
Science	26/05/2017	
Risk assessment conducted by	Highest Rated risk:	
Robert Campebll	6	

Hazards Present: (Choose from Physical (P), Chemical(C), Biological (B), Ergonomic (E), Psychological (PY) (e.g. Check storage/slippery area, dangerous liquids, waste, storage, electric equipment, lights, faulty equipment)	Who might be harmed and how?	Is the risk adequately controlled? List existing controls. (e.g. Signs, instructions, department policy, staff/student training)	L	S	R	What further controls/action is required? (e.g. Discussion/information sharing, signs, create lists/checks)	Action By whom and by when	Date Completed
			3	2	6			
			1	4	4			
			3	1	3			

Investigating the effect of pH on amylase activity

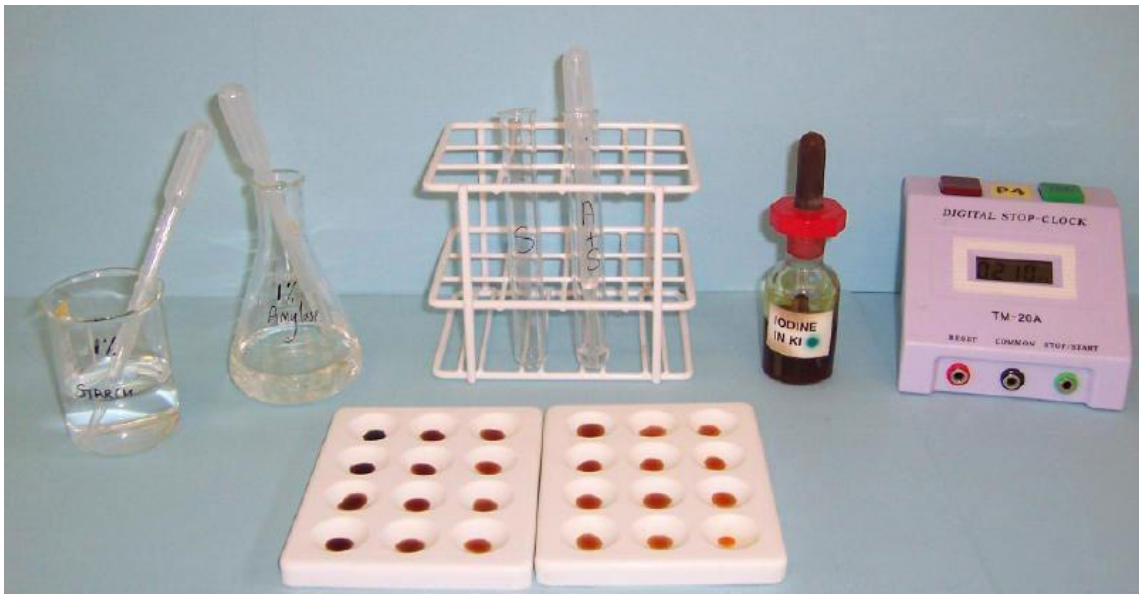
This practical allows you to:

- discover how pH affects the rate of an enzyme-controlled reaction
- evaluate the experimental procedure

Procedure

SAFETY:
Follow your teacher's instructions for handling the solutions.
Wear eye protection when handling the iodine solution.

Investigation



a Place single drops of iodine solution in rows on the tile.
b Label a test tube with the pH to be tested.
c Use the syringe to place 2 cm^3 of amylase into the test tube.
d Add 1 cm^3 of buffer solution to the test tube using a syringe.
e Use another syringe to add 2 cm^3 of starch to the amylase/ buffer solution. Start the stop clock and leave it on throughout the test. Mix using a plastic pipette.
f After 10 seconds, use the plastic pipette to place one drop of the mixture on the first drop of iodine. The iodine solution should turn blue-black. Squirt the rest of the solution in the pipette back into the test tube.
g Wait another 10 seconds. Then remove a second drop of the mixture to add to the next drop of iodine.
h Repeat step **g** until the iodine solution and the amylase/ buffer/ starch mixture remain orange.
i You could prepare a control drop for comparison with the test drops. What should this contain?
j Count how many iodine drops you have used, each one equals 10 seconds of reaction time.

k Repeat the whole procedure with another of the pH buffers or pool your results with others in your class.
l Collect repeat data if there is time.
m Plot a graph of time taken for starch to break down against pH.
OR
Calculate the rate of the reaction by calculating 1 ÷ time. Plot rate of reaction against pH.

Working scientifically skill evaluating results

QUESTIONS

1 It is important to add the buffer to the enzyme before adding the starch. Why is this?

2 How does a *control* help you with the colour comparison?

3 Are there any anomalies or inconsistencies in your results?

4 Do you think your results are reliable? How would repeating the investigation help you to check the reliability?

5 Describe your graph(s). What is the effect of pH on the enzyme-controlled reaction?

6 Explain how pH affects enzyme reactions.

7 How could you improve this investigation?

8 Describe how you would modify this activity to investigate the effect of temperature on the rate of breakdown of starch by amylase.

Space to answer questions and self-review

Q1

Q2

Q3

Q4

Q5

Q6

Q7

Q8

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Working scientifically skill planning experiments

Enzymes Required Practical GCSE AQA past paper question

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

A student is asked to investigate the effect of pH on the enzyme amylase. Some of the equipment they were provided with is shown below:

- test tubes
- a test tube rack
- water bath (electrical or Bunsen burner and beakers)
- spotting tiles
- $5cm^3$ measuring cylinder
- syringes
- a stop clocks
- starch solution
- amylase solution
- buffered solutions covering a range of pH, each with a labelled syringe/ plastic pipette
- iodine solution
- syringes.

Describe how they could carry out this investigation

Working scientifically analysing results edexcel biology paper 1 higher June 2018

8 Potato cells contain the enzyme catalase.

This enzyme catalyses the breakdown of hydrogen peroxide into oxygen and water.

Figure 15 shows what happened when a student placed a potato disc in a 5% hydrogen peroxide solution.

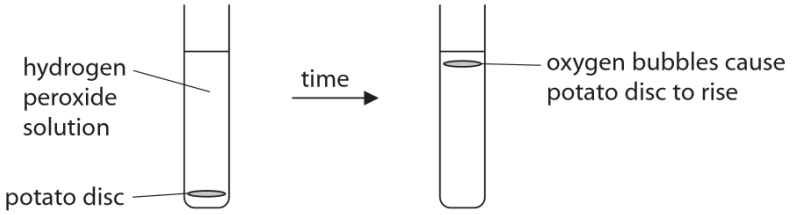

Figure 15

The student measured the time taken for the potato disc to rise.

The student repeated the investigation using 10%, 15% and 20% concentrations of hydrogen peroxide solution.

(a) (i) Which term describes the hydrogen peroxide in this reaction?

(1)

- ☒ **A** product
- ☒ **B** substrate
- ☒ **C** active site
- ☒ **D** control

(ii) The potato discs all had the same mass.

Explain why the student used potato discs with the same mass.

(2)

(b) Figure 16 shows the results of this investigation.

The student calculated the rate of reaction using

$$\frac{1}{\text{time in seconds}}$$

concentration of hydrogen peroxide solution (%)	time taken for disc to rise (s)	rate (s^{-1})
5	325	0.003
10	245	0.004
15	132	0.008
20	72	0.014

Figure 16

(i) State and explain a conclusion based on these results.

(4)

Question Number	Answer	Mark
8(a)(i)	B substrate **1. The only correct answer is B** ***A*** *is not correct because oxygen and water are the products* ***C*** *is not correct because the active site is part of the catalase enzyme* ***D*** *is not correct because a control would using water and not hydrogen peroxide*	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	• mass is a variable/ controlling a variable (1) • so the results could be compared/equal amount of catalase in each reaction (1)	accept the idea that different masses would need more or less oxygen/rise quicker or slower ignore references to fair test or reliable results accept enzyme for catalase	**(2)** AO 2 2

Question Number	Answer		Mark
8(b) (i)	**Conclusion for 1 mark** • increasing the concentration of hydrogen peroxide {increases the rate of reaction/decreases the time taken for the disc to rise} (1) **and any three from:** • provides more substrate (1) • increases collisions (1) • more active sites occupied (1) • forming more enzyme-substrate complexes (1) • oxygen is released faster (1)	 accept hydrogen peroxide for substrate accept more oxygen released	**(4)** AO 3 2a AO 3 2b

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Practical 2: Investigating effect of temperature on the activity of lipase

This practical gives you a chance to:

- investigate how lipase activity changes with temperature
- consider how indicators can help us to follow chemical reactions.

Procedure

SAFETY: Keep the phenolphthalein solution away from naked flames.
Wear eye protection and quickly rinse any splashes of enzyme solution or sodium carbonate from the skin.
Make sure you know what to do if a thermometer is broken.

Investigation

Label a test tube with the temperature you will be investigating.
Add 5 drops of phenolphthalein to the test tube.

Measure out 5 cm^3 of milk using a measuring cylinder (or syringe) and add this to the test tube.

Measure out 7 cm^3 of sodium carbonate solution using another measuring cylinder (or syringe) and add this to the test tube. The solution should now be pink.

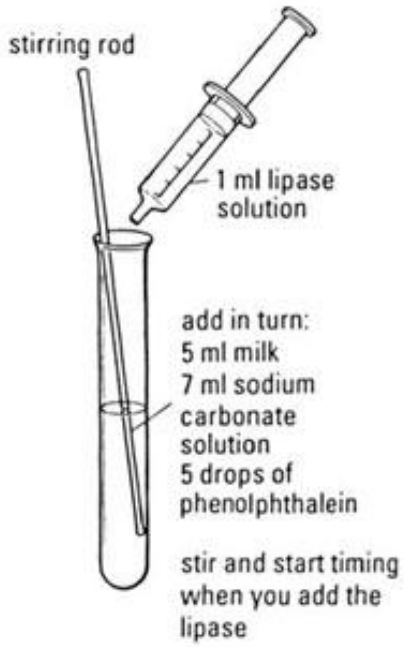
Place a thermometer in the test tube. Take care as the equipment could topple over.

Place the test tube in a water bath and leave until the contents reach the same temperature as the water bath.

Remove the thermometer from test tube and replace it with a glass rod.

Use the 2 cm^3 syringe to measure out 1 cm^3 of lipase from the beaker in the water bath for the temperature you are investigating.

Add the lipase to the test tube and start the stopclock/ stopwatch.
Stir the contents of the test tube until the solution loses its pink colour.
Stop the clock/ watch and note the time in a suitable table of results.



Working scientifically skill recording data

Plot a graph of time taken for the reaction to occur against temperature.
You can convert this to a rate of reaction graph by calculating 1 ÷ time for each of the temperatures. (If any tubes have not reacted in the time taken, this is a rate of zero.)

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Working scientifically skill writing conclusions

QUESTIONS

1 . When fat breaks down, what is produced

2 . Use this information to explain why the phenolphthalein changes colour.

3 . What is the effect of temperature on the time taken for lipase to break down the fat in milk?

4 . Why does the temperature affect the action of lipase in this way?

5 . What is the difference between a 'time taken' and a 'rate of reaction' curve for this investigation?

6 . Why is it necessary to break down fat in the digestive system?

7 . Use other sources of information to find out about:

- bile salts and their effects on digestion of fats
- what happens to the fatty acids and glycerol once they have been absorbed from the digestive tract.

Space to answer questions and self-review

Q1

Q2

Q3

Q4

Q5

Q6

Q7